CALIFORNIA DEPARTMENT OF TRANSPORTATION

Independent Assurance Program Annual Report
Calendar Year 2009

Division of Engineering Services
Materials Engineering and Testing Services
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1. OVERVIEW

1.1. INTRODUCTION

Title 23 of the *Code of Federal Regulations*, Chapter I, Part 637, Subpart B, Section 637.205(a) (23CFR637.205(a)), the Federal Highway Administration's (FHWA's) quality assurance procedures for construction require the following:

> Each STD [state transportation department] shall develop a quality assurance program which will assure that the materials and workmanship incorporated into each Federal-aid highway construction project on the NHS [National Highway System] are in conformity with the requirements of the approved plans and specifications, including approved changes.

Key components of this quality assurance program are "acceptance" and "independent assurance." Independent Assurance (IA) programs may be project or system-based. The California Department of Transportation (Caltrans) has chosen to implement a system-based IA program.

Agencies choosing to implement a system-based IA Program are required by 23CFR637.207(a)(2)(iv) to submit an annual report. In fulfillment of this requirement, this report is being submitted concerning activities of the Caltrans IA Program for calendar year 2009.

1.2. ANNUAL REPORT OVERVIEW

The Caltrans Independent Assurance (IA) Program provides a framework for ensuring that the quality assurance program, as outlined in the Caltrans *Construction Manual* and in project specifications, is supported by qualified technicians and accredit laboratories. The Caltrans IA Program provides periodic evaluation of the performance of sampling and testing personnel, testing equipment, and testing laboratories.

The purpose of this document is to provide:

- A discussion of IA activities from January through December 2009
- A discussion of the current IA Program
- Information on the Reference Sample Program (RSP)

1.3. SUMMARY OF ACTIVITIES: CALENDAR YEAR 2009

- **New IA Staff Certification** – Materials Engineering and Testing Services (METS) IA staff certified 4 new district IA staff and 5 new local assistance IA staff.

- **District IA Staff Recertification** – METS IA staff recertified 22 district IA staff.

- **The 2009 Annual IA Meeting** - The 2009 Annual IA Meeting was held on January 12 and 13, 2010. Issues such as: AASHTO accreditation, equipment calibration and district IA concerns were discussed.

- **District Process Reviews** - METS IA staff conducted district IA process reviews in the 12 districts.

- **Technician Qualification** – Materials Engineering and Testing Services (METS) IA staff and district IA staff qualified a total of 2846 technicians in Caltrans, local agencies and commercial laboratories.

- **Laboratory Accreditation** - METS IA staff and district IA staff accredited a total of 394 Caltrans, local agency and commercials laboratories.

- **Equipment Calibration by METS IA Staff** – METS IA staff calibrated large equipment in 13 Caltrans and 16 local agency testing laboratories.

- **Reference Sample Program (RSP)** - The Reference Sample Program sent out proficiency samples to participating laboratories in PCC, soil, and coarse aggregate.

2. CALTRANS INDEPENDENT ASSURANCE (IA) PROGRAM

2.1. BACKGROUND

Since 1992, Caltrans has been committed to an IA program. Guidance for the program is outlined in the *Caltrans Independent Assurance Manual*, which can be located at the following website address:

<http://www.dot.ca.gov/hq/esc/Translab/ofpm/IAP.htm>

In 1994, Caltrans shifted from a project-based process for reviewing technicians, equipment, and results to a system-based process. In the system-based process, a technician's qualifications are ascertained by written examinations, witnessed performance of tests, and results of testing on split samples of materials for corroboration of test results. Caltrans IA staff reviews equipment and laboratories annually; and laboratories participate in a statewide proficiency sampling program. 23CFR637.207(a) provides that this approach removes the necessity of project-specific samples.

Caltrans views independent assurance as an important and integral part of its quality assurance program, but separate from individual project quality assurance efforts. Independent assurance is implemented by METS. The Division of Construction ensures individual project quality assurance. Quality assurance at the project level is outlined in the *Construction Manual*, which is located at the following website address:

<http://www.dot.ca.gov/hq/construc/manual2001/>

In keeping with the requirements of the IA Program and 23CFR637, Section 6-102C(2) of the *Construction Manual* instructs the construction engineer that:

All acceptance testers require certification. No tests or samples are to be taken on Caltrans projects unless the tester is certified in the test being performed.

District	Certified IA Staff			Number of Qualified Technicians			Accredited Laboratories											
							Caltrans			Local Agencies			Private Industry			Total		
	2009	2008	2007	2009	2008	2007	2009	2008	2007	2009	2008	2007	2009	2008	2007	2009	2008	2007
1	2	2	2	120	66	65	14	11	12	1	2	0	4	0	2	19	13	13
2	3	3	2	145	155	77	8	8	14	1	1	1	7	9	5	16	18	14
3	3	3	3	261	124	146	17	13	9	0	2	0	22	25	10	39	40	23
4	3	5	5	501	558	577	10	32	6	0	3	3	30	7	18	40	42	53
5	1	1	1	150	139	98	10	10	9	2	2	3	21	13	8	33	25	21
6	2	2	2	219	239	250	6	5	6	3	2	3	23	25	17	32	32	25
7	4	4	4	211	217	235	8	1	1	0	0	0	19	15	15	27	16	16
8	2	3	4	394	417	336	6	5	5	2	2	2	39	37	29	47	44	36
9	1	2	1	46	45	38	3	2	2	0	0	0	7	4	4	10	6	6
10	2	2	1	187	176	361	6	3	7	0	0	1	20	15	25	26	18	29
11	2	2	2	269	150	194	23	14	28	2	2	1	32	20	27	57	36	42
12	2	2	2	252	225	281	4	4	4	1	1	1	22	20	22	27	25	27
Total of all Districts	27	31	29	2755	2511	2658	115	108	103	12	17	15	246	190	182	373	315	305
Total For HQ IA	1	1	1	0	47	47	6	7	6	0	0	0	0	0	0	6	7	7
Total for Local Assistance IA	5	0	0	91	0	0	0	0	0	8	8	0	7	0	0	15	0	0
Total for Districts and Headquarters	**33**	32	30	**2846**	2558	2705	**121**	115	109	**20**	25	15	**253**	190	182	**394**	322	312

TABLE 1: IA PROGRAM DATA FOR 2009

3. CALTRANS IA PROGRAM IN 2009

Shown in Table 1 is a summary of certified Caltrans IA staff, qualified technicians, and accredited laboratories by district for 2009.

3.1. INDEPENDENT ASSURANCE STAFF CERTIFICATION

In 2009, four new district IA staff were certified to replace retired IA staff in Districts 1, 2 and 6. By the end of 2009, two additional district IA staff left their positions in District 8 and District 11. The replacement staff will be certified in 2010.

Five Local Assistance IA staff hired by METS were trained and certified the week of February 2, 2009. Both the district IA staff and Local Assistance IA staff are certified by taking an exam that covers the Caltrans IA Manual and California Test Methods in field and laboratory testing.

3.2. ANNUAL RECERTIFICATION OF STATEWIDE IA STAFF

METS IA staff audited the districts to recertify staff. METS IA staff recertified 22 district IA staff in all 12 districts. IA staff was trained for the implementation of the following new test methods:

AASHTO T304 - Uncompacted Void Content of Fine Aggregate (FAA)
ASTM D4791 - Flat and Elongated Particles in Coarse Aggregate

Caltrans has adopted these test methods as part of the new Hot Mix Asphalt specifications. District IA staff are now required to accredit laboratories and qualify personnel in these test methods.

3.3. 2010 INDEPENDENT ASSURANCE ANNUAL MEETING

The IA Annual Meeting was held in January 2010. FHWA, METS, district IA staff and the District Materials Engineers were in attendance. Attendance by district IA staff is mandatory for IA recertification. District IA staff that do not attend are required to attend a make-up session.

The following topics were covered:

- Overview of IA program in 2009
- Equipment calibration
- 2009 Reference Sample Program
- AASHTO accreditation for the District Materials Laboratories
- Status of test method changes
- District IA issues

3.4. DISTRICT IA PROCESS

The *Independent Assurance Manual* requires an annual process/peer review to verify district compliance with Caltrans policies regarding independent assurance. The review consists of an examination of IA documents, records and procedures. METS IA staff conducts the review of the district IA program implementation. These reviews are intended to promote statewide uniformity in the Caltrans IA Program.

Districts were reviewed by METS IA staff in 2009. In general, all districts have improved their file systems. METS IA staff will continue to conduct process reviews in 2010.

3.5. TECHNICIAN QUALIFICATION

District IA staff and METS IA staff qualified a total of 2846 technicians in Caltrans, local agency and commercial laboratories in 2009. This is an increase from the 2558 technicians accredited in 2008.

3.5.1 TECHNICIAN DISQUALIFICATIONS

Seven technicians were disqualified by district IA staff due to use of improper test procedures. The testers' qualifications were suspended for six months due to incorrect sampling and test procedures and using equipment with no or invalid calibration stickers. In these cases, no dispute resolution was requested.

3.6 WRITTEN EXAM AND PRACTICAL STATISTICS

The 2009 data provided for the written exams and practical exams is shown in Table 2.

TABLE 2: 2009 EXAM STATISTICS FOR ALL DISTRICTS AND METS

DIST.	INITIAL WRITTEN EXAM FOR QUALIFICATION				INITIAL PRACTICAL EXAM FOR QUALIFICATION				WITNESS OR CORROBORATION TEST FOR REQUALIFICATION			
	# OF TOTAL EXAMS	# FAIL 1ST TIME	# FAIL 2ND TIME	# FAIL 3RD TIME	TOTAL EXAMS	# FAIL 1ST TIME	# FAIL 2ND TIME	# FAIL 3RD TIME	TOTAL EXAMS	# FAIL 1ST TIME	# FAIL 2ND TIME	# FAIL 3RD TIME
1	252	36	3	0	405	7	0	0	785	9	0	0
2	675	44	0	0	661	0	0	0	564	0	0	0
3	877	148	5	1	661	0	0	0	976	8	8	0
4	900	108	0	0	835	54	4	0	1176	42	22	0
5	462	106	17	0	281	15	3	0	332	10	4	0
6	1489	403	37	7	1405	133	9	0	552	10	0	0
7	1066	245	38	6	516	6	0	0	1399	3	0	0
8	1308	142	23	5	652	7	0	0	2269	3	1	0
9	168	23	12	0	138	12	0	0	288	8	2	0
10	607	99	19	3	404	14	3	0	1455	9	0	0
11	1012	172	12	2	800	104	10	0	1215	0	0	0
12	651	160	3	0	250	11	0	0	559	19	0	0
METS IA	30	8	8	2	22	2	0	0	307	0	0	0
LIA 1,2,3	244	76	9	1	182	6	0	0	34	0	0	0
LIA 4,CR	386	59	1	0	296	2	0	0	44	0	0	0
LIA 7,8	36	32	2	0	21	0	0	0	94	0	0	0
LIA 11,12	7	1	0	0	9	0	0	0	0	0	0	0

Note: LIA 1,2,3 – Local Assistance IA staff covering District 1, 2 and 3
LIA 4, CR – Local Assistance IA staff covering District 4 and Central Region.

As shown in the data, the major hurdle in the technician qualification process is passing the written exam and first practical exam.

3.6.1 PRACTICAL EXAMS FOR TECHNICIAN QUALIFICATION

In analyzing the data for the practical exams, the failure rate is lower. Failure to pass the practical examination will occur if improper test equipment is presented, if an uncorrected error in proper test procedure occurs while demonstrating the test procedure, or if the technician fails to complete the paperwork or calculations correctly. An issue for further consideration in the development of the IA Program is to develop a standardized method for the practical examination evaluation where distinct pass/fail criteria are developed.

3.7 LABORATORY ACCREDITATION

In 2009, METS IA and district IA staff accredited a total of 394 Caltrans, local agency and commercials laboratories. This is an increase from the 322 laboratories accredited in 2008.

3.7.1 LABORATORY ACCREDITATION, REVOCATION AND DISPUTE RESOLUTION

Section 2.5, "Dispute Resolution" of the *Caltrans Independent Assurance Manual* states:

"A tester or laboratory my have its entire qualification or accreditation or its qualification or accreditation for specific test methods suspended or revoked if it is found not to conform to IA accreditation requirements."

In 2009, one laboratory had its accreditation suspended due to improper testing procedures and using equipment with invalid calibration decals. Within 7 days, the laboratory had addressed its deficiencies and the accreditation was reinstated.

3.8 CALTRANS LABORATORIES— EQUIPMENT AND CALIBRATION

Since 2002, METS has been instrumental in providing funding for testing equipment for the District Laboratories and Construction field laboratories throughout the state. Funding was provided by METS to the districts again in 2009 to purchase laboratory equipment, to provide required installation/calibration, and to provide staff orientation/training to the new equipment.

3.8.1 PROPER CALIBRATION OF TESTING EQUIPMENT

METS IA staff calibrate all large testing equipment in the district laboratories. In addition, METS IA staff performs calibration of presses and compactors for Caltrans and local agencies on an annual basis. This ensures that all Caltrans' local agency large testing equipment is being calibrated uniformly.

In 2009, METS IA staff calibrated large equipment in 13 Caltrans and 16 local agency laboratories.

For smaller equipment, district IA staff is responsible for verifying the calibration of all testing equipment in accredited field laboratories. Some districts' IA staff are responsible for calibration of equipment in the district and field laboratories. While other districts' IA review the calibration records for district and field laboratories from private calibration services. Overall, all calibration records are reviewed by district IA staff, whether they are directly responsible for calibration of the equipment or not. The

Independent Assurance Manual covers calibration procedures for equipment such as larger presses and scales.

3.9 CALTRANS REFERENCE SAMPLE PROGRAM (RSP) IN 2009

The *Independent Assurance Manual,* Section 2.4.4, "Proficiency Testing" states,

"The laboratory shall participate in all required proficiency sample programs to be accredited."

It is the laboratory's responsibility to maintain active status in proficiency testing of reference samples by testing and reporting the results.

Reference sample results are evaluated using a statistical evaluation system for determining the numerical ratings of each test method. The statistical evaluation method uses the standard deviation from the mean for a given test method as indicated below:

TABLE 6: RATING SYSTEM FOR THE REFERENCE SAMPLE PROGRAM

STATISTICAL VALUE	NUMERICAL RATING	INTERPRETATION OF RESULTS
$X \pm 1.0\ \sigma$	5	Acceptable (Very Good)
$X \pm 1.5\ \sigma$	4	Acceptable (Good)
$X \pm 2.0\ \sigma$	3	Acceptable (Fair)
$X \pm 2.5\ \sigma$	2	Unacceptable (Poor)
$X \pm 3.0\ \sigma$	1	Unacceptable (Very Poor)

If a rating score less than 3.0 is received for any test method performed, the laboratory is required to examine its equipment and/or test procedures to determine why the test result varied appreciably from the mean of the test results obtained by other laboratories. A second sample of material will then be shipped to the laboratory for retesting.

If the results of the second test are acceptable and the causes leading to the original deficiency are corrected and documented, the initial unacceptable rating is considered resolved.

If the results of the second material sample are once again below a 3.0 rating, the individual laboratory must contact IA staff for assistance. A third sample may be run with district IA staff witnessing the testing procedures. Unacceptable ratings, if uncorrected, will result in the loss of laboratory accreditation.

In 2009, samples of Portland cement concrete, soil and coarse aggregate were distributed to participating laboratories.

Full reports for the 2009 Reference Sample Program are located in Appendix A.

3.9.1 GOALS FOR REFERENCE SAMPLE PROGRAM IN 2010

The following table gives an approximate timeline for the 2010 reference sample program:

2010	Sample Type
First quarter	Soil – CT 216
Second quarter	Hot Mix Asphalt – CT 309
Third quarter	Fine Aggregate

3.10 CALTRANS TEST METHOD UPDATES

To address the need for updating Caltrans Test Methods and to coordinate the changes in test methods resulting from the implementation of the new hot mix asphalt specification, three expert task groups (ETG) were formed. These technical working groups include members of industry and Caltrans. District IA staff are members of these technical working groups. The purpose of these groups is to update the current Caltrans test methods to reflect state of the art practices in the hot mix asphalt field.

The groups are as follows:

- Hot Mix Asphalt TG (HMATG): deals with all test methods related to hot mix asphalt
- Aggregate TG (ATG): deals with all test methods related to aggregate for hot mix asphalt
- Other: deals with test methods not in the other categories that relate to hot mix asphalt

These task groups are expected to complete the test method modifications in 2010.

3.11 LOCAL ASSISTANCE INDEPENDENT ASSURANCE PROGRAM

Chapter 16, Section 16.14, "Quality Assurance Program," of the Caltrans Local Assistance Procedures Manual, states **"local agencies must follow Caltrans Quality Assurance Procedures (QAP) for all projects on the NHS"**. Therefore, for local agency projects on the NHS, Caltrans IA staff is responsible for providing IA services to local agencies.

Five positions were transferred between the Division of Local Agencies and the Division of Engineering Services in 2008 to assist DES in providing Caltrans IA services to local agencies for qualifying testers and accrediting laboratories. Local Assistance IA staff interacts on a regular basis with the district local assistance engineer (DLAE).

These five positions were filled in December 2008. Implementation of the Local Assistance IA program began in March 2009. In addition to providing IA services, the Local Assistance IA staff reviews local agency Quality Assurance Program (QAP) manuals for compliance with Caltrans Local Assistance requirements. In 2009, 170 local agency QAP manuals were reviewed by Local Assistance IA staff.

4.0 CALTRANS INDEPENDENT ASSURANCE PROGRAM GOALS

4.1 INDEPENDENT ASSURANCE MANUAL REVISIONS

As a result of lessons learned from the implementation of the 2005 *Independent Assurance Manual,* changes are needed to the current manual. Revisions to the manual are planned for 2010.

4.2 AASHTO ACCREDITATION OF THE DISTRICT MATERIALS LABORATORIES

The State Materials Engineer for Caltrans has determined that central materials testing labs in each district need to be AASHTO accredited within six years. The specific labs are:

- The central materials testing labs in Districts 1, 2, 3, 4, 5, 6, 9, 10, and 11
- The planned Southern Regional Testing Lab for Districts 7, 8 and 12

In 2009, District 2 conducted a pilot program to receive AASHTO accreditation. The timeline toward achieving accreditation is as follows:

- Quality System Manual – completed 1/1/10
- Proficiency Testing Participation
  - Fine aggregates in March 2009
  - Hveem mix design in July 2009
  - R-value in September 2009
  - Coarse aggregates in November 2009
  - Asphalt content in January 2010
- On-Site Assessment
  - Working with AMRL and CCRL to schedule an assessment in 2010

APPENDIX A: RSP Reports for 2009

REFERENCE SAMPLE PROGRAM

PORTLAND CEMENT CONCRETE

2008 PROFICIENCY TEST RESULTS

State of California Department of Transportation

Office of Roadway Materials Testing
Division of Engineering Services
Materials Engineering and Testing Services-MS #5
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REFERENCE SAMPLE PROGRAM PORTLAND CEMENT CONCRETE 2008 PROFICIENCY TEST RESULTS

1. OVERVIEW

The 2008 portland cement concrete (PCC) proficiency tests started in September 2008 and include five California Tests (CT) as below:

- **CT 504 - Air Content of Freshly Mixed Concrete (Pressure Method)**
- **CT 518 - Unit Weight of Fresh Concrete**
- **CT 543 - Air Content of Freshly Mixed Concrete (Volumetric Method)**
- **CT 556 - Slump of Fresh Portland Cement Concrete**
- **CT 557 - Temperature of Freshly Mixed Portland Cement Concrete**

Eighty (80) labs participated in the initial round of testing. Test results were received in October/November 2008 and analyzed in accordance with Caltrans Independent Assurance Program Manual. For labs that failed to achieve an acceptable score in the initial test, an additional sample was sent to the labs for a retest. This report presents test results from both the initial test and the retest.

2. ANALYSIS OF TEST RESULTS

2.1 EVALUATION CRITERIA

Test results were analyzed using a statistical evaluation system in which the mean (X) and standard deviation were calculated for each test parameter. A rating score was then given to the test result based on the criteria shown in Table 1. A test result with a score of 3 or greater was considered acceptable. A test result with a score of 2 or less was considered unacceptable and a retest was required.

Table 1. Evaluation Criteria

Test Result	Rating	Interpretation of Results	Acceptance
X ± 1.0s	5	Very Good	Acceptable
X ± 1.5s	4	Good	
X ± 2.0s	3	Fair	
X ± 2.5s	2	Poor	Unacceptable
X ± 3.0s	1	Very Poor	

4.2 INITIAL TEST

A total of 80 laboratories participated in the initial test. An analysis for outliers in accordance with ASTM E 178 indicated that test results from some of the labs were possible outliers. These outliers as summarized in Table 2.

Table 2. Labs and Test Results Considered as Outliers

CT	# of Outlier	Lab ID
504	1	21
518	13	21, 52, 57, 136, 144, 165, 206, 235, 250, 281, 331, 398, 400
543	1	310
556	13	21, 80, 144, 207, 234, 310, 316, 331, 366, 394, 398, 411, 560
557	2	52, 348

After removing the outliers, the mean value and standard deviation for each test parameter were re-calculated to determine the score for the respective test parameter. The analysis results are presented in Table 3. Detailed test results are provided in Appendix A.

Table 3. Summary of Initial Test Results

Item	# Lab	Average	Standard Deviation	Number of Labs Achieved Score of				
				5	4	3	2	1
CT 504 (Pressure Method)								
Air Content, %	76	2.55	0.40	52	15	4	3	2
			% of Total	68	20	5	4	3
CT 518								
Unit Weight (kg/m^3)	65	2,413.34	59.24	59	2	0	0	4
			% of Total	91	3	0	0	6
CT 543 (Volumetric Method)								
Air Content, %	47	2.66	0.46	36	8	0	2	1
			% of Total	77	17	0	4	2
CT 556								
Slump, mm	59	31.05	15.85	32	19	5	3	0
			% of Total	54	32	8	5	0
CT 557								
Temperature, °C	76	24.87	4.23	56	9	5	5	1
			% of Total	74	12	7	7	1

4.3 RETEST

In the initial test, 35 laboratories did not receive an acceptable score in one test or multiple tests. Samples for a retest were sent to these labs in early 2009. Most of these labs submitted test results. Of these labs, eight labs did not participate in the initial test or submitted their initial test results late. These labs are: 15, 32, 76, 304, 414, 420, 429, and 452. Their results were included in the analysis of the retest results.

Eight laboratories failed one or multiple tests in the initial test but they did not submit results in the retest. These labs are: 20, 52, 57, 75, 165, 206, 348, and 387.

The outlier analysis was performed following ASTM E-178. After removing outliers, the score for each lab by each test parameter was determined by comparing the retest result with the rating range from the initial test. Table 4 presents the mean value and standard deviation for each test parameter from the retest. Detailed test results and scores are provided in Appendix B.

Table 4. Summary of Retest Results

Item	# Lab	Average	Standard Deviation	Number of Labs Achieved Score of				
				5	4	3	2	1
CT 504 (Pressure Method, PM)								
Air Content, %	17	2.58	0.28	14	1	2	0	0
			% of Total	82	6	12	0	0
CT 518								
Unit Weight (kg/m^3)	19	2424.73	23.11	19	0	0	0	0
			% of Total	100	0	0	0	0
CT 543 (Volumetric Method, VM)								
Air Content, %	10	2.34	0.28	8	1	1	0	0
			% of Total	80	10	10	0	0
CT 556								
Slump, mm	25	40.29	13.52	14	6	4	1	0
			% of Total	56	24	16	4	0
CT 557								
Temperature, °C	14	20.70	4.15	7	3	2	2	0
			% of Total	50	22	14	14	0

4.4 COMBINED RESULTS

A total of 88 laboratories participated in the PCC reference sampling program. A number of labs participated in both the initial and the retest. Table 5 shows combined scores from both the initial test and the retest. The final combined scores are provided in Appendix C.

Table 5. Summary of Combined Test Results

Test Method	# Lab	Number of Labs Achieved Score of				
		5	4	3	2	1
CT 504	83	65	15	6	0	0
	% of Total	75	18	7	0	0
CT 518	79	77	1	0	0	1
	% of Total	98	1	0	0	1
CT 543	52	41	9	1	1	0
	% of Total	79	17	2	2	0
CT 556	79	46	23	9	1	0
	% of Total	59	29	11	1	0
CT 557	84	63	10	7	4	0
	% of Total	75	12	8	5	0

4.5 OBSERVATIONS

There are a number of labs that failed in the initial and/or the retest. Caltrans representatives witnessed retests after the second failure. The major problems related to lack of attention to specific test instructions and not following the test method procedures.

5 SUMMARY

- CT 504 – 83 labs participated, all labs achieved an acceptable score.
- CT 518 – 79 labs participated, 99% of the participating labs achieved an acceptable score.
- CT 543 – 52 labs participated, 98% of the participating labs achieved an acceptable score.
- CT 556 – 79 labs participated, 99% of the participating labs achieved an acceptable score.
- CT 557 – 84 labs participated, 95% of the participating labs achieved an acceptable score.

6 REFERENCES

ASTM, "Standard Practice for Dealing with Outlying Observations," Designation E 178 – 80.

Caltrans, "Independent Assurance Manual," Sacramento, July 2005.

APPENDIX – A

Test Results from Initial Test

Lab No	CT 504 (PM)		CT 518		CT 543 (VM)		CT 556		CT 557	
	Air Content, %	Score	Density, (kg/m^3)	Score	Air Content, %	Score	Slump, mm	Score	Tempe-rature, C°	Score
18	2.2	5	2420.9	5			20	5	24.5	5
20	2.05	4	2449.6	5			55	3	15.5	2
21		O		O				O	24.5	5
24	2.3	5	2420.6	5	3	5	35	5	26	5
29	2.2	5	2425.2	5	3	5	5	3	32	3
42							40	5	28	5
46	3	4	2430	5	3	5	45	5	22.5	5
48	3	4	2424.5	5					23.5	5
49	2.4	5	2450.9	5			30	5	24.5	5
50			2091.9	1					29.5	4
52	2.6	5		O	2.75	5	25	5		O
57	2.9	5		O	2.5	5	51	4	19	4
58	3.6	1	2411.4	5			10	4	29	5
62	2.7	5	2431.1	5	2.75	5	30	5	27	5
65	2.6	5	2435	5	2.5	5	32	5	25.5	5
67	3	4	2390	5	2.75	5	35	5	27.5	5
71	2.5	5	2424.9	5			40	5	19.5	4
74	2.5	5	2260.2	1	2.5	5	50	4	22.5	5
75	2.5	5	2339	4	3.75	2	15	4	27	5
80	2.7	5	2414.3	5	3.25	4		O	21.5	5
87	2	4	2445.1	5	2.5	5	15	4	21	5

Lab No	CT 504 (PM)		CT 518		CT 543 (VM)		CT 556		CT 557	
	Air Content, %	Score	Density, (kg/m^3)	Score	Air Content, %	Score	Slump, mm	Score	Tempe-rature, C°	Score
88	2.7	5	2409.2	5	2.75	5	40	5	26.5	5
91	2.5	5	2441.2	5	2.25	5	32	5	25.5	5
125	3.4	2	2414.5	5	3	5	50	4	24.5	5
131	2.3	5	2429.2	5			15	4	31	4
136	2.5	5		O	2.75	5	35	5	20.5	4
144	2.3	5		O	2.25	5		O	23	5
145	2.5	5	2417.5	5			30	5	24.5	5
158	2	4	2427.2	5			25	5	23.5	5
163	2.7	5	2454	5	2.75	5	40	5	24	5
165	2.5	5		O	2.5	5	19	5	34.5	2
166	2.5	5	2410.2	5	3	5	55	3	21.5	5
177	2.2	5	2434.6	5	2.25	5	65	2	24	5
186	2.8	5	2410.8	5	3	5	15	4	28.5	5
192	2	4	2460.6	5	2.75	5	50.8	4	21.7	5
206	2	4		O			60	3	27.5	5
207	3	4	2402.8	5				O	27	5
214	2.4	5	2387	5			65	2	22.4	5
223	3	4	2424.3	5	3.25	4	30	5	24	5
234	2.1	4	2401.5	5	2.25	5		O	18.5	3
235	2.5	5		O					14.5	2
236	2.4	5	2411	5	2.5	5	64	2	23.5	5
237	3.3	3	2414.4	5			40	5	27.5	5
244	2.3	5	2436.9	5	2	4	30	5	20.5	4
248	2.6	5	2420.9	5	3	5	20	5	32	3
250	2.75	5		O	2.75	5	25	5	20.5	4

Lab No	CT 504 (PM)		CT 518		CT 543 (VM)		CT 556		CT 557	
	Air Content, %	Score	Density, (kg/m^3)	Score	Air Content, %	Score	Slump, mm	Score	Tempe-rature, C°	Score
261							13	4	31.5	3
263	2.6	5	2416.9	5	3	5	20	5	27	5
270	2.5	5	2439.6	5	2.5	5	13	4	23	5
273	2.1	4	2447.6	5	2.5	5	20	5	23.5	5
274	1.5	1	2438.5	5	2.25	5	40	5	25	5
280	2.1	4	2364.8	5			55	3	24.5	5
281	2.9	5		O			12	4	36	1
293	2.5	5	2423.5	5	2.5	5	15	4	21	5
310	3.5	2	2326.9	4		O		O	35	2
316	2.3	5	2421	5				O	25.5	5
322	2.8	5	2390.6	5	3.25	4	40	5	28	5
326	3.2	3	2428.4	5	3.25	4	15	4	24.5	5
331	2.6	5		O	4	1		O	26.5	5
338	2.4	5	2587.1	1					14.5	2
348	3	4	2410.8	5						O
351	2.8	5	2424.8	5			15	4	27	5
358	2.6	5	2431.7	5			10	4	26	5
359	2.7	5	2429.3	5	2	4	15	4	25	5
361	2.3	5	2441	5	2	4	45	5	25	5
366	1.7	2	2408.1	5	1.6	2		O	24.4	5
375	2.5	5	2435.3	5			35	5	21	5
387	2.8	5	2250	1	2.75	5	25	5	26.5	5
394	1.9	3	2415.8	5	2	4		O	22	5
398	2.8	5		O	2.5	5		O	20	4
399	2.6	5	2444.8	5						

Lab No	CT 504 (PM)		CT 518		CT 543 (VM)		CT 556		CT 557	
	Air Content, %	Score	Density, (kg/m^3)	Score	Air Content, %	Score	Slump, mm	Score	Tempe-rature, C°	Score
400	2.3	5		O	2.25	5	25	5	23.3	5
411	2.3	5	2429.6	5	2.25	5		O	25.5	5
415	2.5	5	2404	5			20	5	24	5
418	2.4	5	2453.5	5					32.5	3
419	3	4	2388.7	5						
424	2.5	5	2436.1	5			15	4	20	4
558	2.5	5	2405.5	5	2.75	5	15	4	25	5
560	3.3	3	2442	5				O	29	5
582	2.3	5	2458.7	5	2.25	5	30	5	27	5

Legend:

1, 2 Unacceptable score O Outlier

APPENDIX - B

Test Results from Retest

Lab No.	CT 504 (PM)		CT 518		CT 543 (VM)		CT 556		CT 557	
	Air Content, %	Score	Density, (kg/m^3)	Score	Air Content, %	Score	Slump, mm	Score	Tempe-rature, C°	Score
15*			2400.3	5			65	2	21.5	5
21	2.52	5	2424.0	5			10	4		
32*	1.8	3	2462.0	5	1.75	3	25	5	18.4	3
50			2381.9	5						
58	2.4	5								
74	2.5	5	2428.1	5	2.5	5	30	5		
76*	2.8	5	2442.8	5			25	5	16.5	3
80							50	4		
125	2.4	5	2428.8	5	2.5	5	50	4	19.0	4
136			2384.9	5						
144	2.5	5	2413.5	5	2.25	5	55	3	19.0	4
177							45	5		
207							51	4		
214							25	5		
234							42	5		
235	2.6	5	2440.1	5					14.7	2
236							50	4		
250			2382.9	5						
274	2.5	5								
281			2433.3	5					22.0	5
304*	2.6	5	68.7	O	2.5	5	25	5	26.0	5
310	2.8	5	2416.6	5	2.25	5	35	5	24.5	5

316							30	5		
331			2423.7	5	2.5	5	100	O		
338	2.6	5	2440.1	5					14.7	2
366	2.5	5			2.65	5	31.75	5		
394							55	3		
398			2454.4	5			31.5	5		
400	3.1	4	2425.64	5						
411							45	5		
414*			17.2	O			30	5	19.5	4
420*	3.2	3	2428.0	5	2.5	5	55	3	23.3	5
429*	2.5	5	2458.8	5			40	5	29	5
452*	2.5	5	68.4	O	2	4	51	4	21.7	5
560							55	3		

Legend:

1, 2 Unacceptable score O Outlier

* Lab did not submit test results in the initial test or submitted results later. The test results were included in the analysis of the retest.

Labs failed in the initial test but did not submit test results in the retest are:

20, 52, 57, 75, 165, 206, 348, 387

APPENDIX - C

Combined Final Scores from both Initial Test and Retest

Lab No	CT 504 Final Score	CT 518 Final Score	CT 543 Final Score	CT 556 Final Score	CT 557 Final Score
15		5		2	5
18	5	5		5	5
20	4	5		3	2
21	5	5		4	5
24	5	5	5	5	5
29	5	5	5	3	3
32	3	5	3	5	3
42				5	5
46	4	5	5	5	5
48	4	5			5
49	5	5		5	5
50		5			4
52	5	O	5	5	O
57	5	O	5	4	4
58	5	5		4	5
62	5	5	5	5	5
65	5	5	5	5	5
67	4	5	5	5	5
71	5	5		5	4
74	5	5	5	5	5

Lab No	CT 504 Final Score	CT 518 Final Score	CT 543 Final Score	CT 556 Final Score	CT 557 Final Score
75	5	4	2	4	5
76	5	5		5	3
80	5	5	4	4	5
87	4	5	5	4	5
88	5	5	5	5	5
91	5	5	5	5	5
125	5	5	5	4	5
131	5	5		4	4
136	5	5	5	5	4
144	5	5	5	3	5
145	5	5		5	5
158	4	5		5	5
163	5	5	5	5	5
165	5		5	5	2
166	5	5	5	3	5
177	5	5	5	5	5
186	5	5	5	4	5
192	4	5	5	4	5
206	4			3	5
207	4	5		4	5
214	5	5		5	5
223	4	5	4	5	5
234	4	5	5	5	3
235	5	5			2

Lab No	CT 504 Final Score	CT 518 Final Score	CT 543 Final Score	CT 556 Final Score	CT 557 Final Score
236	5	5	5	4	5
237	3	5		5	5
244	5	5	4	5	4
248	5	5	5	5	3
250	5	5	5	5	4
261				4	3
263	5	5	5	5	5
270	5	5	5	4	5
273	4	5	5	5	5
274	5	5	5	5	5
280	4	5		3	5
281	5	5		4	5
293	5	5	5	4	5
304	5	O	5	5	5
310	5	5	5	5	5
316	5	5		5	5
322	5	5	4	5	5
326	3	5	4	4	5
331	5	5	5	O	5
338	5	5			2
348	4	5			
351	5	5		4	5
358	5	5		4	5
359	5	5	4	4	5

Lab No	CT 504 Final Score	CT 518 Final Score	CT 543 Final Score	CT 556 Final Score	CT 557 Final Score
361	5	5	4	5	5
366	5	5	5	5	5
375	5	5		5	5
387	5	1	5	5	5
394	3	5	4	3	5
398	5	5	5	5	4
399	5	5			
400	5	5	5	5	5
411	5	5	5	5	5
414		O		5	4
415	5	5		5	5
418	5	5			3
419	4	5			
420	3	5	5	3	5
424	5	5		4	4
429	5	5		5	5
452	5	O	4	4	5
558	5	5	5	4	5
560	3	5		3	5
582	5	5	5	5	5

Legend:

1, 2 Unacceptable score

O Outlier

REFERENCE SAMPLE PROGRAM

R-VALUE OF UNTREATED SOILS

2009 PROFICIENCY TEST RESULTS

State of California Department of Transportation

Office of Roadway Materials Testing
Division of Engineering Services
Materials Engineering and Testing Services-MS #5
5900 Folsom Blvd
Sacramento, California 95819-4612

July 30, 2009

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Table 1. Evaluation Criteria 1
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REFERENCE SAMPLING PROGRAM
R-VALUE OF UNTREATED SOILS
2009 PROFICIENCY TEST RESULTS

1. OVERVIEW

The R-value of untreated soils proficiency tests started in January 2009. Eighty two (82) laboratories participated in an initial test. Test results were received between February and June and analyzed in accordance with Caltrans Independent Assurance Program Manual. For laboratories failed to achieve an acceptable score in the initial test, an additional sample was sent to the laboratories for a retest. This report presents test results from both the initial test and the retest.

2. ANALYSIS OF TEST RESULTS

2.1 EVALUATION CRITERIA

Test results were analyzed using a statistical evaluation system in which the means (X) and standard deviation (s) were calculated for each test parameter. A rating score was then given to the test result based on the criteria shown in Table 1. A test result with a score of 3 or greater was considered acceptable. A test result with a score of 2 or less was considered unacceptable and a retest was required.

Table 1: Evaluation Criteria

Test Result	Rating	Interpretation of Results	Acceptance
X ± 1.0s	5	Very Good	Acceptable
X ± 1.5s	4	Good	
X ± 2.0s	3	Fair	
X ± 2.5s	2	Poor	Unacceptable
X ± 3.0s	1	Very Poor	

2.2 INITIAL TEST

A total of 82 laboratories participated in the initial test; of which 58 laboratories from the private sector and 24 from the public sector. An analysis of outlier conducted by following ASTM E 178 indicated that the test result from one laboratory (Lab ID 80) was a possible outlier.

After removing the outlier, the mean value and standard deviation were re-calculated for determining the score for each participating laboratory. The analysis results are presented in Table 2. Detailed test results are provided in Appendix A.

Table 2: Summary of Initial Test Results

Sector	# Lab	Average	Standard Deviation	Number of Labs Achieved Score of				
				5	4	3	2	1
Private	58*	29.8	9.9	41	9	4	3	0
% of Total				72	16	7	5	0
Public	24	31.3	11.6	14	5	4	1	0
% of Total				58	21	17	4	0
Combined	82*	30.2	10.4	55	14	8	4	0
% of Total				68	17	10	5	0

* Test result from Lab 80 is considered as an outlier and it is not included in the summary.

Simple statistical analyses, F test on variance and t-test on means, suggest that the test results between the private and the public laboratories are statistically the same at a significant level of 5 percent.

2.3 RETEST

A couple of laboratories (Lab ID 80 and 144) that did not receive an acceptable score in the initial test submitted their test results from the retest. Lab 144 with an R-value of 17 received a satisfactory score and lab 80 with an R-value of 8 did not receive a satisfactory score.

3. OBSERVATIONS

A number of observations were made during the review of the test results. They include that some laboratories:

- did not report results with required units or mixed use of units;
- did not report exudation pressure;
- did not report R-value by Stabilometer;
- did not report horizontal pressure (Stabilometer Ph) @8900 N;
- only reported 2 test results, should report 3 test results;
- reported R-value by Stabilometer but did not report final R-value at 2.07 MPa (300 psi) exudation pressure;
- reported R-value by Stabilometer as the final R-value; and
- reported R-value that could not be verified using the laboratory provided data.

Inconsistence in the test data from various laboratories required a significant effort to evaluate the test results. Reasonable assessment was made to interpret the test data provided by each laboratory; in some cases, testing labs were contacted for additional information or clarification.

Overall, 78 out of 82 laboratories (95%) received an acceptable score.

4. REFERENCES

ASTM, "Standard Practice for Dealing with Outlying Observations," Designation E 178 – 80.

Caltrans, "Independent Assurance Manual," Sacramento, July 2005.

APPENDIX – A

Test Results from Initial Test

Private Laboratory						Public Laboratory		
Lab No.	R-Value	Final Score	Lab No.	R-Value	Final Score	Lab No.	R-Value	Final Score
23	52	2	153	28	5	77	22	5
31	28	5	161	54	2	158	34	5
32	30	5	163	23	5	16	11	3
42	19	4	177	36	5	21	24	5
43	48	3	206	27	5	24	29	5
49	20	5	207	47.6	3	310	19	4
59	26	5	210	38	5	20	12	3
63	44	4	212	22	5	131	48	3
66	21	5	216	29	5	17	15	4
70	32	5	223	49	3	46	29	5
71	25	5	234	18	4	354	35	5
73	21	5	244	33	5	64	39	5
75	18	4	248	25	5	149	52	2
.79	26	5	255	32	5	15	26	5
80[1]	4	O	263	31	5	1	42	4
88	27	5	272	25	5	2	25	5
90	13	3	274	18	4	3	48	3

91	38	5	303	23	5	4	41	4
94	26	5	311	25	5	5	36	5
96	25	5	316	15	4	6	20	5
102	35	5	322	36	5	8	43	4
104	28	5	356	29	5	9	26	5
106	23	5	383	34	5	10	40	5
112	25	5	393	36	5	11	34	5
128	31	5	394	30	5			
131	16.6	4	447	38	5			
143	24	5	451	25	5			
144[2]	54	2	581	18	4			
145	34	5	582	42	4			

O = Outlier

[1] Lab 80, with an R-value of 8 from the retest, received a score 2.

[2] Lab 144, with an R-value of 17 from the retest, received a score 4.